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(54) **Valve structure of indwelling catheter**

Klappenstruktur für Verbleibskatheter

Valve pour cathétère résident

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## Description

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

[0001] This invention relates to an indwelling catheter for use in artificial dialysis, fluid infusion, or blood infusion, and more particularly, to an indwelling catheter which avoids backflow of blood outside the catheter when the needle is inserted/removed and allows a connector to be connected thereto with very small force, reducing load to a patient.

#### 2. Description of the Related Art

[0002] United States Patent No. 5,911,710 discloses prior art related to an indwelling catheter and according to the preamble of claim 1. The indwelling catheter disclosed is a medical insertion device for introducing an elongated tube into a blood vessel and manipulating the tube while maintaining hemostasis. The indwelling catheter has a sheath housing and a shuttle housing. A sheath valve is fitted inside the sheath housing. A shuttle tube is provided in the shuttle housing. When the shuttle housing is pushed forward, the shuttle tube makes the sheath valve open. The use of this indwelling catheter allows tube manipulation while maintaining hemostasis.

### SUMMARY OF THE INVENTION

[0003] The above indwelling catheter has a hemostatic valve provided in the vicinity of an insertion opening of the shuttle housing for securely maintaining hemostasis in the shuttle housing. When a tube for a drip injection or the like is connected thereto, secured hemostasis is required between the tube and the shuttle housing using the hemostatic valve prior to commencing the opening operation of the sheath valve. The operation of inserting the tube into the hemostatic valve induces a great resistance force, causing the patient much discomfort. The series of operations are complicated, inviting operational errors.

[0004] This invention was made to solve the above problems, and has an object of providing an indwelling catheter with good maneuverability, securely maintaining hemostasis in a catheter body with an easy operation.

[0005] An indwelling catheter according to the invention as defined in claim 1 comprises: a hollow catheter body; a catheter tube fitted to a front end of the catheter body; an elastic valve fitted inside the catheter body; and a hollow plug slidably fitted inside the catheter body. The catheter tube, the elastic valve, and the plug are coaxially aligned in this order. A connector inserted from a proximal end of the catheter pushes the plug, and the plug presses the elastic valve open.

[0006] To introduce the indwelling catheter of this in-

vention into the body of a patient, a needle is inserted from a proximal end of the catheter body to protrude the tip of the needle out from a front end of the catheter tube. The needle presses the elastic valve open, closely contacting with the valve, thereby securely providing hemostasis. The removal of the needle makes the elastic valve close, so that hemostasis is maintained until a drip tube or the like is connected. The connector for connecting a drip tube or the like, when inserted from the proximal end of the catheter body, presses the rear end of the plug with its front end, sliding the plug forward. Then the front end of the plug presses the elastic valve open, maintaining homeostasis and easily providing connection between the drip tube or the like and the indwelling catheter.

[0007] An indwelling catheter according to a second aspect of this invention has a biasing means for biasing the plug in a direction opposite to the elastic valve. The biasing means comprises a coil spring or a bellows.

[0008] In the indwelling catheter according to the second aspect, the removal of the connector makes the plug return to its original position by the biasing means, making the elastic valve automatically close, and thereby providing hemostasis. Thus the exchange of a drip tube or the like does not require a special operation for hemostasis. This facilitates the exchange of a drip tube or the like.

### BRIEF DESCRIPTION OF THE DRAWINGS

#### [0009]

FIG. 1 is a longitudinal cross-sectional view of an indwelling catheter according to a first embodiment of this invention, being ready for insertion into the body of a patient;

FIG. 2 is a longitudinal cross-sectional view of the indwelling catheter of FIG. 1 with a needle removed; FIG. 3 is a longitudinal cross-sectional view of the indwelling catheter of FIG. 2 with a connector connected thereto;

FIG. 4 is a longitudinal cross-sectional view of the indwelling catheter of FIG. 3 with the connector removed;

FIG. 5 is a longitudinal cross-sectional view of an indwelling catheter according to a second embodiment of this invention, being ready for insertion into the body of a patient;

FIG. 6 is a longitudinal cross-sectional view of the indwelling catheter of FIG. 5 with a needle removed; FIG. 7 is a longitudinal cross-sectional view of the indwelling catheter of FIG. 6 with a connector connected thereto;

FIG. 8 is a longitudinal cross-sectional view of the indwelling catheter of FIG. 7 with the connector removed;

FIG. 9 is a longitudinal cross-sectional view of an indwelling catheter according to a third embodiment

of this invention, being ready for insertion into the body of a patient;

FIG. 10 is a longitudinal cross-sectional view of the indwelling catheter of FIG. 9 with a needle removed; FIG. 11 is a longitudinal cross-sectional view of the indwelling catheter of FIG. 10 with a connector connected thereto; and

FIG. 12 is a longitudinal cross-sectional view of the indwelling catheter of FIG. 11 with the connector removed.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010] With reference to FIGS. 1 to 4, a first embodiment of this invention will be described in detail below.

[0011] An indwelling catheter A according to the first embodiment of this invention has, as shown in FIG. 1, a hollow catheter body 1, a catheter tube 2 fitted into a tube holder 1b provided at a distal end of the catheter body 1, an elastic valve 3 fitted inside the catheter body 1, and a hollow plug 4 slidably fitted inside the catheter body 1. The catheter tube 2, the elastic valve 3, and the plug 4 are coaxially aligned in this order.

[0012] The catheter body 1 is made from resin or a like material, and has a tubular shape. An inner surface 1a is tapered toward the distal end, with a gradually reduced diameter.

[0013] The catheter body 1 is preferably of a transparent or semi-transparent material so as to show the interior, enabling checking of movement inside.

[0014] The catheter tube 2 is made from resin such as polyamide, and is press-fitted into the tube holder 1b which communicates at its proximal end with the inside of the catheter body 1.

[0015] It is preferred that a lubricating coating is provided to the entirety or part of the catheter tube 2 so as to reduce resistance caused by insertion through skin or into a blood vessel.

[0016] The elastic valve 3 is of a generally tubular shape, having a closed front surface. The front surface centrally has an openable/closable valve aperture 3a. At an inner surface of a rear opening of the valve 3, an annular protrusion 3b to engage the plug 4 is provided.

[0017] The valve aperture 3a is closed watertight when the plug 4 and the needle 5 are not inserted therethrough, providing hemostasis. With the plug 4 inserted therethrough, the valve aperture 3a expands forward and opens, providing communication between the catheter tube 2 and the rear of the catheter body 1.

[0018] The annular protrusion 3b protrudes inwardly so as to slidably contact with an outer periphery of the plug 4. The protrusion 3b engages a shoulder 4c provided at a distal end of the plug 4 so as to slidably prevent the dislocation of the plug 4.

[0019] A plurality of gaps 3c is defined between an outer periphery of the elastic valve 3 and the inner surface 1a of the catheter body 1. Distal and proximal spaces

divided by the elastic valve 3 communicate with each other through the gaps 3c. Thus the elastic valve 3 slides smoothly with air passing through the gaps 3c.

[0020] The plug 4 is made from resin or a like material, and has an inner passageway. The plug 4 has a tubular portion 4a, a conical flange 4b connected to the rear end of the tubular portion 4a, and the shoulder 4c protruding from an outer periphery of the tubular portion 4a.

[0021] A front end of the tubular portion 4a is chamfered to facilitate its penetration into the valve aperture 3a of the elastic valve 3, and is slidably supported by the annular protrusion 3b of the elastic valve 3.

[0022] The conical flange 4b has a conical inner surface so as to facilitate insertion of the needle 5 thereinto.

The peripheral surface of the flange 4b contacts the inner surface 1a of the catheter body 1 and serves to provide stability to the plug 4 and maintain the coaxial position with respect to the catheter tube 2.

[0023] The indwelling catheter A of this embodiment is prepared for use in such a state as shown in FIG. 1 with the front end of the needle 5 protruding from the front end of the catheter tube 2. In this state, the needle 5 penetrates through the elastic valve 3, providing water-tight connection therebetween, and thereby preventing leakage of blood.

[0024] The indwelling catheter A in this state is inserted into the body of a patient. Then, as shown in FIG. 2, the needle 5 is removed with the tube 2 retained in the body of the patient. The elastic valve 3, being retained in position by an annular protrusion 1e, still remains in the catheter body 1 when the needle 5 is removed, being closed to maintain hemostasis.

[0025] Then, the connector 6 is inserted from the rear end of the catheter body 1. When pressed into the catheter body 1, the connector 6 pushes at its front end the plug 4. The plug 4 thus slides forward to press at its front end the valve aperture 3a of the elastic valve 3 open. The elastic valve 3 is then pressed against the inner surface of a tapered cavity 1c of the catheter body 1 as shown in FIG. 3, and stops its movement, thus providing communication between the catheter tube 2 and a tube for a drip or the like. The tapered inner surface 1a of the catheter body 1 allows for smooth insertion of the connector 6 and tight contact between an outer surface 6a of the connector 6 and the inner surface 1a through press fitting. The plug 4 is brought into close contact with the elastic valve 3, and the outer surface 6a of the connector 6 is brought into close contact with the inner surface 1a of the catheter body 1, securely providing hemostasis.

[0026] With reference to FIGS. 5 to 8, a second embodiment of this invention will be described. In these figures, elements substantially identical with those in the first embodiment are referred to with the same reference numerals. Different or new elements are referred to with new reference numerals.

[0027] An indwelling catheter B according to the second embodiment has the structure identical to that of the

indwelling catheter A, and further includes a coil spring 7 biasing a plug 4 in a direction opposite to an elastic valve 3. The coil spring is made from a resilient material and is fitted between the elastic valve 3 and the plug 4.

[0028] A connector 6 is inserted from the rear of a catheter body 1 to press the plug 4 against the biasing force of the coil spring 7. The front end of the plug 4 then penetrates into a valve aperture 3a of the elastic valve 3, providing connection between a catheter tube 2 and a drip tube or the like as shown in FIG. 7.

[0029] Then, the connector 6 is removed, and the plug 4 is returned to its original position by the biasing force of the coil spring 7 as shown in FIG. 8. The elastic valve 3 is thus closed, providing hemostasis. That is, the removal of the connector 6 does not require a special operation for hemostasis, resulting in hemostasis being reliably maintained.

[0030] With reference to FIGS. 9 to 12, a third embodiment of this invention will be described. In these figures, elements substantially identical with those in the first embodiment are referred to with the same reference numerals. Different or new elements are referred to with new reference numerals.

[0031] An indwelling catheter C according to the third embodiment has the structure identical to that of the indwelling catheter B, and has a bellows 8 in place of the coil spring 7 for biasing a plug 4 in a direction opposite to an elastic valve 3. The bellows 8 is made from a resilient material and is fitted between the elastic valve 3 and the plug 4.

[0032] A connector 6 is inserted from the rear of a catheter body 1 to press the plug 4 against the biasing force of the bellows 8. The front end of the plug 4 then penetrates into a valve aperture 3a of the elastic valve 3, providing connection between a catheter tube 2 and a drip tube or the like as shown in FIG. 11.

[0033] Then the connector 6 is removed, and the plug 4 is returned to its original position by the biasing force of the bellows 8 as shown in FIG. 12. The elastic valve 3 is thus closed, providing hemostasis. That is, the removal of the connector 6 does not require a special operation for hemostasis, resulting in hemostasis being securely maintained.

## Claims

### 1. An indwelling catheter, comprising:

a hollow catheter body (1) having a proximal and distal end;  
a catheter tube (2) fitted to the distal end of the catheter body (1);  
an elastic valve (3) fitted inside the catheter body (1); and  
a hollow plug (4) slidably fitted inside the catheter body (1); wherein,  
the catheter tube (2), the elastic valve (3), and

the plug (4) are coaxially aligned in this order; and characterised in that insertion of a connector from the proximal end of the catheter body (1) into the catheter body pushes the plug (4), and the plug (4) presses the elastic valve (3) open.

2. An indwelling catheter as set forth in claim 1, wherein the catheter body (1) has an inner surface (1a) in a tapered shape.
3. An indwelling catheter as set forth in claim 1 or 2, wherein one or more gaps (3c) are provided between the elastic valve (3) and the catheter body (1), to provide an air passage.
4. An indwelling catheter as set forth in claim 1 to 3, wherein the plug (4) is slidably prevented from slipping out from inside the catheter body (1).
5. An indwelling catheter as set forth in claim 1 to 4, wherein the plug (4) is slidably fitted to the elastic valve (3).
6. An indwelling catheter as set forth in claim 1 to 5, wherein the elastic valve (3) has an annular inwardly directed protrusion (3b), and the plug (4) has an outer shoulder (4c) slidably engaging the annular protrusion (3b), the plug (4) being prevented from slipping out from the elastic valve (3).
7. An indwelling catheter as set forth in claim 1 to 6, further comprising a biasing means (7,8) fitted outside the plug, the biasing means biasing the plug (4) in a direction opposite to the elastic valve (3).
8. An indwelling catheter as set forth in claim 7, wherein the biasing means comprises a bellows (8) or a spring coil (7) made of a resilient material.

## Patentansprüche

### 1. Dauerkatheter, umfassend:

einen Hohlkatheterkörper (1) mit einem proximalen und einem distalen Ende;

eine Katheterröhre (2), die an das distale Ende des Katheterkörpers (1) angebracht ist;

ein elastisches Ventil (3), dass in dem Katheterkörper (1) sitzt; und

einen Hohlstecker (4), der gleitbar in den Katheterkörper (1) eingesetzt ist; wobei

die Katheterröhre (2), das elastische Ventil (3)

und der Stecker (4) koaxial in dieser Reihenfolge aneinandergereiht sind, und **dadurch gekennzeichnet, dass** das Einschieben eines Verbindungsmittels von dem proximalen Ende des Katheterkörpers (1) in den Katheterkörper den Stecker (4) schiebt und der Stecker (4) das elastische Ventil (3) aufdrückt.

2. Dauerkatheter nach Anspruch 1, worin der Katheterkörper (1) eine Innenfläche (1 a) mit einer sich verjüngenden Form hat. 10
3. Dauerkatheter nach Anspruch 1 oder 2, worin ein oder mehrere Zwischenräume (3c) zwischen dem elastischen Ventil (3) und dem Katheterkörper (1) vorgesehen sind, um einen Luftdurchgang zu ergeben. 15
4. Dauerkatheter nach Anspruch 1 bis 3, worin der Stecker (4) gleitend am Herausrutschen aus dem Inneren des Katheterkörpers (1) gehindert ist. 20
5. Dauerkatheter nach Anspruch 1 bis 4, worin der Stecker (4) gleitbar an dem elastische Ventil (3) angebracht ist. 25
6. Dauerkatheter nach einen der Ansprüche 1 bis 5, worin das elastische Ventil (3) einen nach innen gerichteten, ringförmigen Vorsprung (3b) hat, und der Stecker (4) eine äußere Schulter (4c) hat, die gleitend den ringförmigen Vorsprung (3b) einrastet, wobei der Stecker (4) am Herausrutschen aus dem elastischen Ventil (3) gehindert ist. 30
7. Dauerkatheter nach einem der Ansprüche 1 bis 6, weiterhin umfassend Federmittel (7, 8), die außen auf dem Stecker angebracht sind, wobei die Federmittel des Steckers (4) in entgegengesetzter Richtung zu dem elastischen Ventil (3) angebracht sind. 35
8. Dauerkatheter nach Anspruch 7, worin die Federmittel einen Balg (8) oder eine Sprungfeder (7) aus einem elastischen Material umfassen. 40

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## Revendications

1. Cathéter à demeure comprenant :

un corps de cathéter creux (1) ayant une extrémité proximale et une extrémité distale ; 50  
 un tube de cathéter (2) monté à l'extrémité distale du corps de cathéter (1) ;  
 une soupape élastique (3) montée à l'intérieur du corps de cathéter (1) ; et 55  
 un piston creux (4) monté à coulissement à l'intérieur du corps de cathéter (1) ; où  
 le tube de cathéter (2), la soupape élastique (3)

et le piston (4) sont alignés coaxialement dans cet ordre ; et **caractérisé en ce que** l'insertion d'un connecteur depuis l'extrémité proximale du corps de cathéter (1) dans le corps de cathéter pousse le piston (4), et le piston (4) presse la soupape élastique (3) en position ouverte.

2. Cathéter à demeure selon la revendication 1 où le corps de cathéter (1) a une surface interne (1a) de forme effilée.
3. Cathéter à demeure selon la revendication 1 ou 2 où un ou plusieurs interstices (3c) sont prévus entre la soupape élastique (3) et le corps de cathéter (1) pour établir un passage pour l'air.
4. Cathéter à demeure selon les revendications 1 à 3 où le piston (4) est empêché à coulissement de glisser de l'intérieur du corps de cathéter (1).
5. Cathéter à demeure selon les revendications 1 à 4 où le piston (4) est monté à coulissement sur la soupape élastique (3).
6. Cathéter à demeure selon les revendications 1 à 5 où la soupape élastique (3) a une protubérance annulaire dirigée vers l'intérieur (3b), et le piston (4) a un épaulement externe (4c) coopérant à coulissement avec la protubérance annulaire (3b), le piston (4) étant empêché de glisser hors de la soupape élastique (3).
7. Cathéter à demeure selon les revendications 1 à 6 comprenant en outre un moyen de sollicitation (7, 8) monté à l'extérieur du piston, le moyen de sollicitation sollicitant le piston (4) dans une direction opposée à la soupape élastique (3).
8. Cathéter à demeure selon la revendication 7 où le moyen de sollicitation comprend un soufflet (8) ou un ressort à boudin (7) en un matériau élastique.

FIG.1

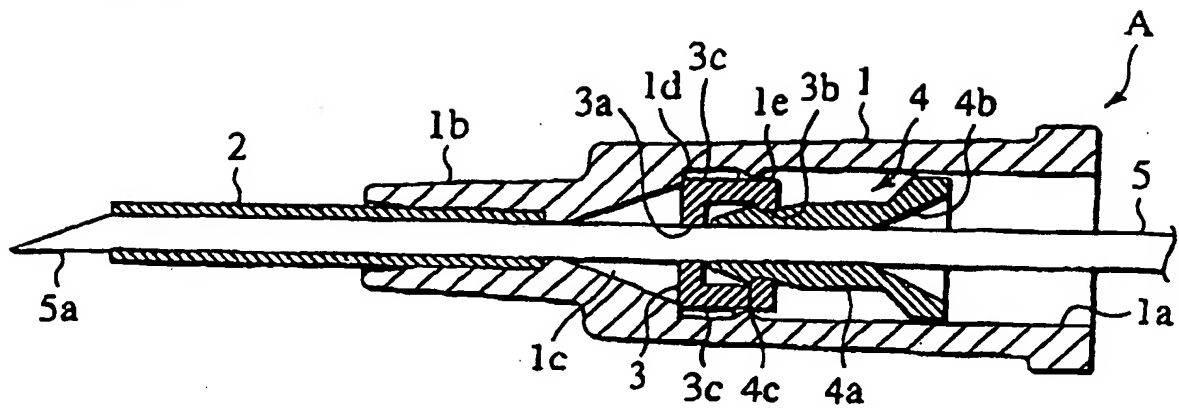


FIG.2

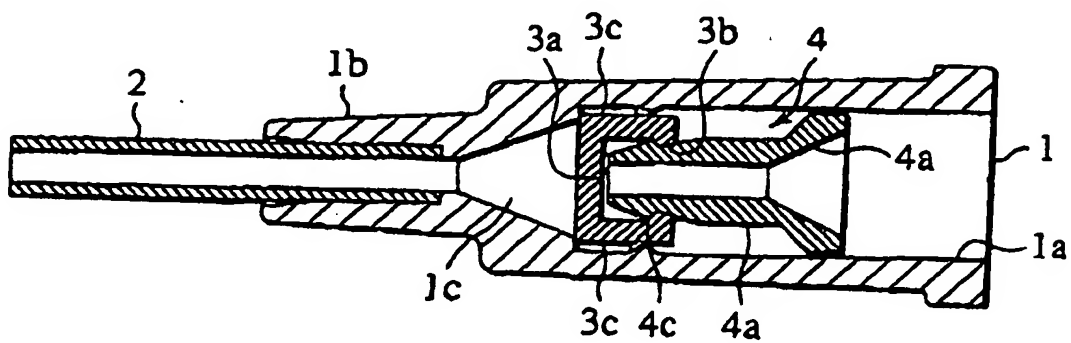


FIG.3

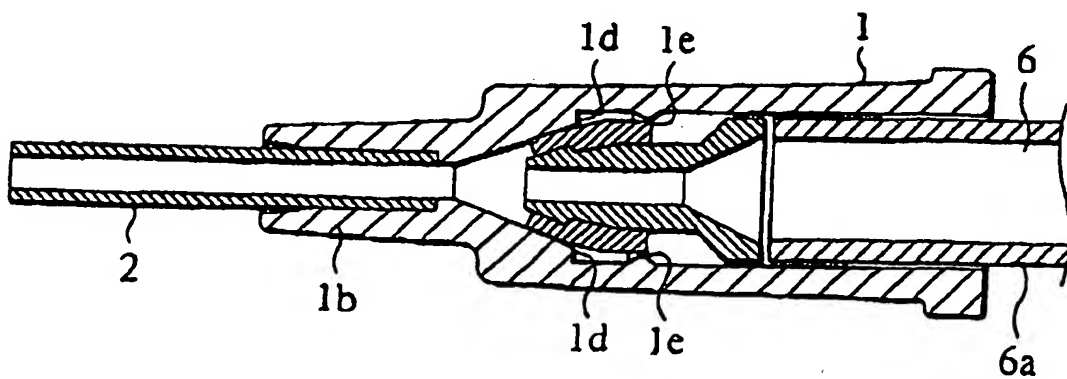


FIG.4

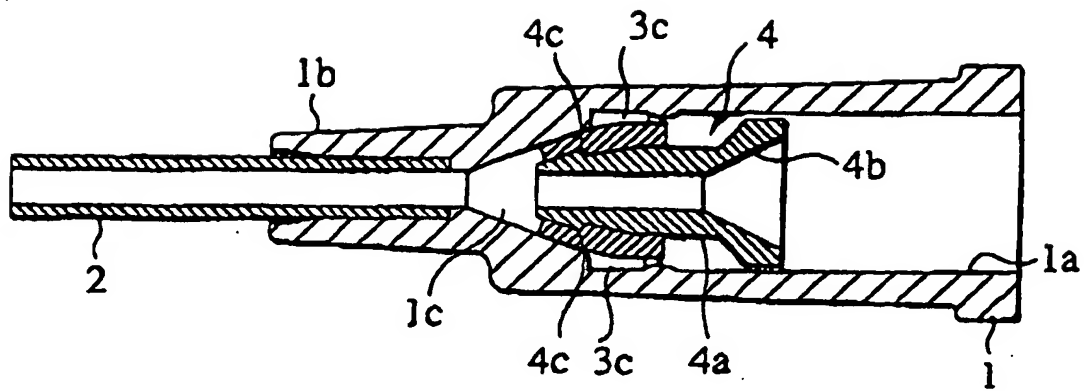


FIG.5

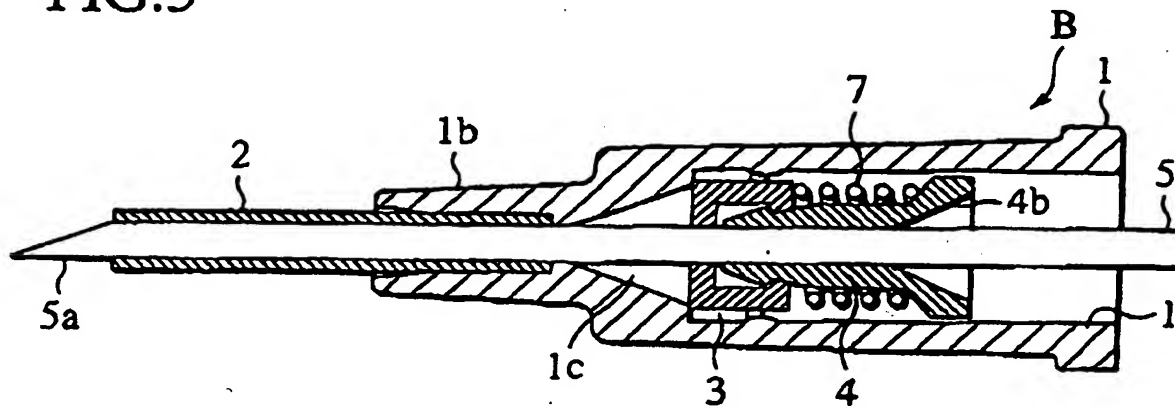


FIG.6

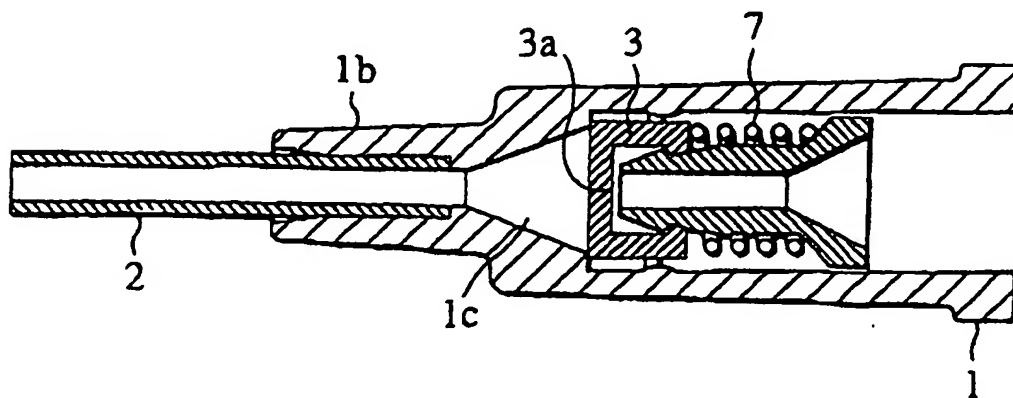


FIG. 7

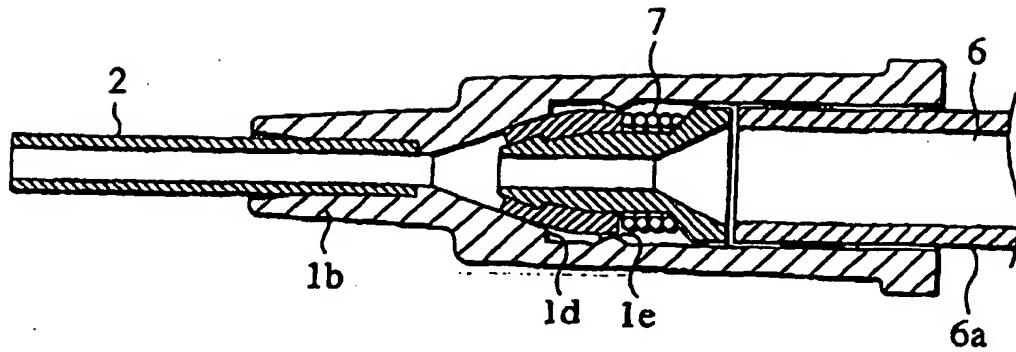


FIG.8

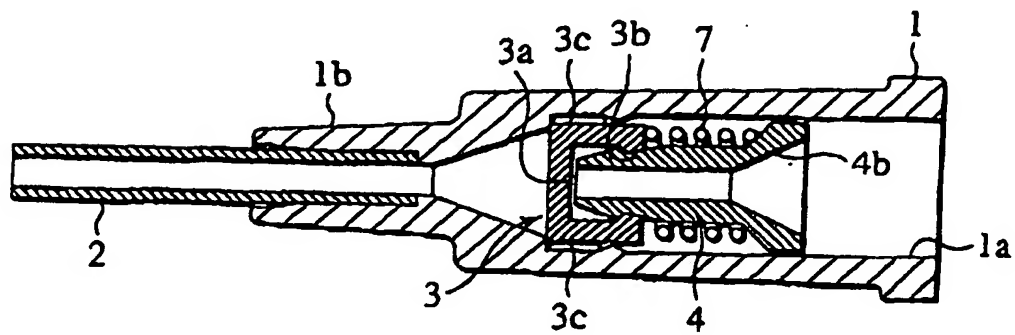


FIG.9

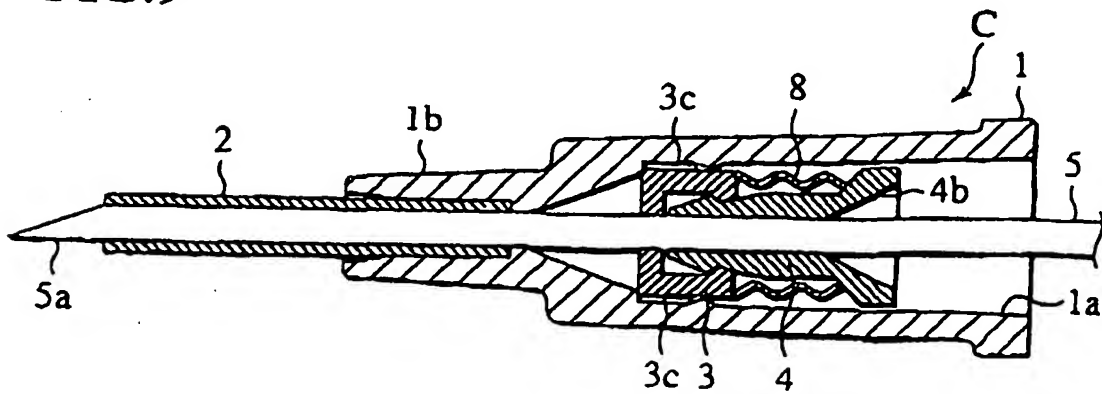


FIG.10

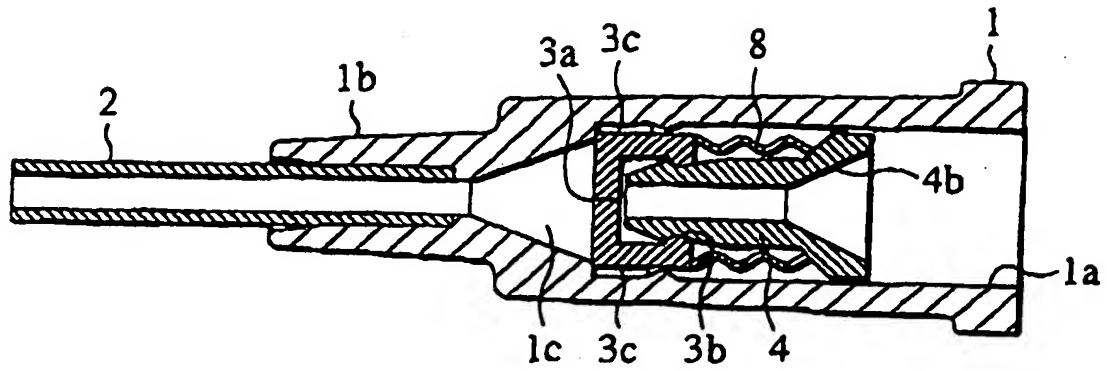


FIG.11

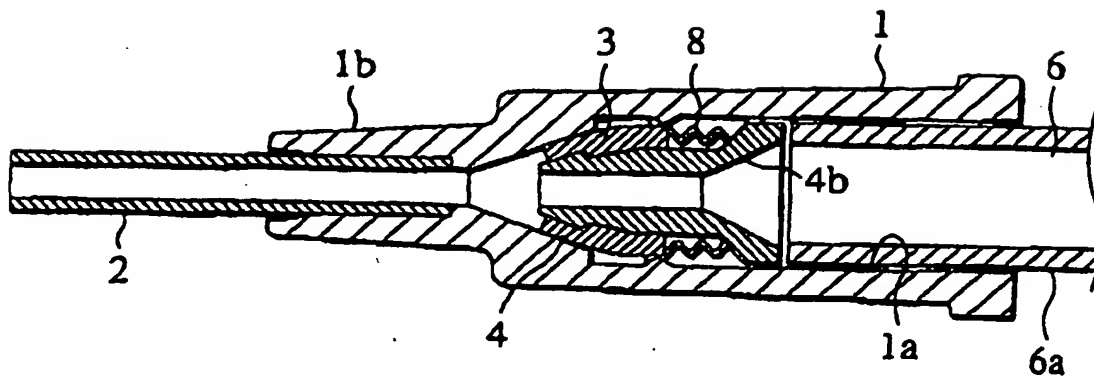


FIG.12

